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A REVISION OF THE NORTH AMERICAN GENUS *SABATIA* (GENTIANACEAE)¹

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THE genus *Sabatia* is restricted in distribution to continental North America and the West Indies. It is frequently encountered throughout much of its range, which extends from Nova Scotia south as far as the mountains of Hispaniola and the central plateau of Mexico and from the Atlantic seaboard westward to the prairies of Oklahoma and central Texas. All of the members of the genus recognized in this paper, seventeen species and two varieties, are to be found in the southeastern United States. The distribution of most of them is either entirely restricted to that area or is largely centered there. Most of the entities are either found in or are restricted entirely to the Coastal Plain, the oldest portions of which have been available to the occupancy of land plants only since the close of the Cretaceous.

This genus is believed to be an ancient one whose intrageneric divisions appear to have been clear-cut and well-defined for a long period of time. Even the species seem, in most instances, to be genetically so well isolated from their closest relatives as to show no indication of hybridization even when flowering in close proximity to one another. These are almost certainly indications of great age.

This group of plants has not been monographically treated since the time of Grisebach (1845) although it has been subjected

¹ Part of a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the University of Michigan. I should like to take this opportunity to express my appreciation for the friendship, encouragement and guidance of Dr. Rogers McVaugh throughout this investigation.

to numerous regional interpretations. The present treatment is based upon the examination of more than 6500 specimens borrowed from over thirty herbaria² and the prized opportunity, made possible largely through the assistance of Professor H. H. Bartlett, director of the Botanical Gardens of the University of Michigan, of studying all but one of the species in the field.

HISTORY OF THE GENUS

Plants now considered to belong to *Sabatia* were first described as species of *Gentiana* in Gronovius' "Flora Virginica" (1739). Linnaeus, having assisted Gronovius in that work, was personally familiar with the specimens upon which the two polynomials were based and later provided binomials for both of them in "Species Plantarum" (1753). Two additional species, based upon specimens collected by Kalm, were described for the first time in that work. Three of these species were placed by Linnaeus in the genus *Chironia* together with four very different species from the Old World while the remaining species known to him was assigned to the genus *Swertia*. Later he transferred one of the species that he had formerly assigned to *Chironia* to *Chlora* and thus the four different species known to Linnaeus were treated as representatives of three different genera.

Adanson (1763), resisting what seemed to him to be the excessive generic "lumping" of Linnaeus, recognized many pre-Linnean genera and initiated some new ones as well. *Sabatia*,

² The abbreviations employed in referring to these herbaria are those of Lanjouw and Stafleu (1952) and are as follows:

BRU	Brown University	NCU	University of North Carolina
CHARL	Charleston Museum	NO	Tulane University
CU	Cornell University	NY	New York Botanical Gardens
DENN	Dennison University	OKL	University of Oklahoma
DUKE	Duke University	OKLA	Oklahoma A. & M. College
F	Chicago Natural History Museum	PENN	University of Pennsylvania
FLAS	Florida Agr. Exp. Sta.	RUT	Rutgers University
GA	University of Georgia	SMU	Southern Methodist Univ.
GH	Gray Herbarium	TAES	A. & M. College of Texas
K	Kew (part of collection)	TENN	University of Tennessee
KSC	Kansas State College	TEX	University of Texas
MICH	University of Michigan	UARK	University of Arkansas
MO	Missouri Botanical Garden	UC	University of California
MT	Université de Montréal	US	U. S. National Herbarium
NA	U. S. National Arboretum	WIS	University of Wisconsin
NCS	North Carolina State College	WVA	West Virginia University
		YU	Yale University

one of the latter, was entirely based upon "Gentiana Gron. virg. 29" which Linnaeus had called *Chironia dodecandra*. Later authors frequently "corrected" Adanson's spelling of the generic name to *Sabbatia* since it was proposed in commemoration of an Italian botanist called Liberato Sabbati. In the "Familles des Plantes" the generic name *Sabatia* is invariably spelled with a single "b" while the botanist's name always appears as Sabbati. One can therefore only conclude that Adanson deliberately chose to spell the generic name as *Sabatia* and, according to Article 82 of the International Code of Botanical Nomenclature, his choice in this matter is binding.

Pursh (1814) accepted Adanson's genus but defined it to include all of the American species which had been placed by most earlier authors in the genus *Chironia*. Grisebach (1839, 1845) provided a very complete account of the eleven species and one variety that were known to him in his two monographic treatments of the Gentianaceae. These monographs were very similar in regard to the species of *Sabatia*, with the exception of the disposition of *S. gentianoides*. In the first account this species was considered to form a monotypic section while six years later its distinctive characteristics were warranted to be of generic status and, furthermore, it was then placed in a different subtribe from that of its former congeners.

Gray's understanding of those species found within the United States was summarized in the "Synoptical Flora" (1878) in which he recognized thirteen species and two varieties.

Blake (1915) provided a formalized system of classification for the genus by arranging the twenty-two species and one variety accepted by him into named subgenera, sections and subsections. This was in large part merely the application of subgeneric names and validating diagnoses to the groups of species that long had been associated together under the synoptical and indented keys of earlier authors.

GENERIC RELATIONSHIPS

Sabatia was associated in Gilg's (1895) treatment of the family in the tribe Gentianeae, subtribe Erythraeinae together with seventeen other genera. Most of the genera of the Erythraeinae are composed of but few species and more than half

of the genera are known only from the Old World. None of them seem particularly closely related to *Sabatia*. This genus has been placed most often near *Centaureum* Hill (= *Erythraea* Borkh.) from which it may be distinguished by many characters. The following key employs some of their more obvious differences.

- Corolla rotate, the lobes much longer than the tube; stigma deeply 2-lobed, the lobes at least one-third the length of the style, at anthesis spirally twisted about one another but uncoiling and spreading apart with time; anthers either half-twisted laterally or becoming circinnately coiled or recurved after pollen discharge SABATIA.
- Corolla salverform, the lobes equal to or shorter than the tube; stigma capitate or but barely creased, the divisions scarcely discernible, position unchanged with age; anthers becoming tightly spirally coiled in the manner of a corkscrew after pollen discharge CENTAURIUM.

SYSTEMATIC TREATMENT

SABATIA Adans., *Fam. Pl.* 2: 503. 1763.

Pleienta Raf., *Fl. Tell.* 3: 30. 1837.

Neurola Raf., *New Fl.* 4: 92. 1838.

Erect, glabrous, annual or perennial herbs. If perennial, sometimes stoloniferous and either arising from a short, erect caudex or from a short to elongate, almost always branched rhizome. Root-system of the annuals either a slender tap-root or a cluster of fibrous roots, that of the perennials a cluster of wiry to fleshy roots. Leaves mostly cauline but basal leaves also present in some species, decussate (or in aberrant specimens whorled), entire, sessile or somewhat amplexicaul, membranous to thick and turgid or even fleshy. Branches opposite or alternate. Inflorescence cymose, the cymules either compactly subcapitately clustered or loosely arranged, being often reduced to one or two flowers, or grouped into large, showy, compound dichasia. Flowers perfect, actinomorphic. Calyx 5-12(-14)-parted, gamosepalous, the tube campanulate to somewhat turbinate, membranous, the lobes minute to foliaceous, varying in length from shorter than the calyx-tube to many times longer. Corolla rotate, 5-12(-14)-parted, the tube urceolate to cylindrical, short but equaling or more commonly exceeding the calyx-tube; corolla-lobes usually widely spreading, dextrorsely contorted in bud. Stamens 5-12; filaments slender, inserted on the upper edge of the corolla-tube, alternating with the corolla-lobes, at first erect but strongly curving to one side after pollen discharge; anthers basally attached, linear to oblong, slender to stout, dehiscing laterally by means of longitudinal slits, after pollen discharge becoming either laterally twisted or circinnately recurved or revolute. Ovary bicarpellate, unilocular; carpel margins slightly intruding into locule and forming 4 parietally located placental lobes each bearing numerous scattered ovules. Style slender; stigmatic

branches 2, linear to slightly spatulate, tightly spirally twisted at anthesis and bent to one side, later becoming erect, untwisting and exposing the densely papillate stigmatic surface. Capsule globose, ovoid, or cylindrical. Seeds numerous, globose or somewhat flattened, densely pitted with small depressions. TYPE SPECIES: *Sabatia dodecandra* (L.) BSP. (*Chironia dodecandra* L.)

KEY TO THE SECTIONS

Flowers usually long-pedicellate or, if short-pedicellate, the subtending bracts small and scale-like; flowers either solitary or loosely cymose; anthers becoming circinnately recurved after pollen discharge; plants, if annual, pentapetalous, if perennial, either pentapetalous or pluripetalous.

I. EUSABATIA.

Flowers sessile or very nearly so, the subtending bracts large and leaf-like; inflorescence of few to several closely associated flowers, appearing capitate; anthers slightly twisted laterally even prior to pollen discharge, never becoming circinnately recurved; plants annual and pluripetalous.

II. PSEUDOCHIRONIA.

I. Section EUSABATIA Griseb., Gen. et Sp. Gent. 120. 1839.

Subg. *Eusabatia* (Griseb.) Blake, RHODORA 17: 56. 1915.

Annuals or perennials. Flowers either pentamerous or plurimerous (only the perennials 7-12(-14)-merous); typically long—pedicellate or at least not appearing to be sessile and capitately arranged with the clusters possessing large foliaceous bracts. Anthers becoming revolutely coiled or recurved after pollen discharge. TYPE SPECIES: *Sabatia dodecandra* (L.) BSP.

The fifteen species belonging to this, the larger, section of the genus show considerable diversity and may be arranged readily into several groups of species (subsections).

KEY TO THE SUBSECTIONS

- A. Calyx-tube very prominently 5-nerved and thinly membranous-winged; the lateral nerves of the calyx-lobes much more strongly developed than the midnerve; flowers pentamerous; annuals. (C) CAMPESTRES.
- A. Calyx-tube smooth or finely nerved and lacking membranous wings; the midnerve of the calyx-lobes almost equaling or even more strongly developed than the lateral nerves; annual or perennial and flowers either pentamerous or plurimerous.
- B. Perennials with elongate rhizomes; some species stoloniferous; either pentamerous or plurimerous.
- C. Branches typically opposite throughout; flowers mostly 5-parted, the centermost in the cymules occasionally 6-parted; corolla white and lacking yellow "eye" at base of lobes; pedicels usually less than 1 cm. long; stolon and basal rosettes never present. . . (A) DIFFORMES.
- C. Branches typically alternate (at least the uppermost); flowers 5-12 (-14)-parted (3 species 7-14-parted, the other species 5-6(-7)-parted); corolla typically pink or rose and with a yellow "eye" in the throat and base of the lobes; pedicels mostly over 1 cm. long; stolons and basal rosettes present in some species.

(E) DODECANDRAE

- B. Annuals or, if perennials, the caudex short, erect, and much-branched; rhizomes and stolons never present; flowers pentamerous.
- D. Upper branches typically opposite; basal rosette present at some stage of life-cycle and often persistent; annuals. (B) ANGULARES.
- D. Upper branches typically alternate; basal rosette lacking; either annuals or perennials. (D) CAMPANULATAE.

(A) DIFFORMES subsect. nov.,³ Subsect. *Angulares* Blake
in part, RHODORA 17: 56. 1915.

Robust perennials arising from a thick, gnarled, often much-branched, elongate rhizome bearing numerous fleshy roots about 2 mm. in diameter. Branches typically opposite. Leaves drying thick-chartaceous, margins revolute. Corolla white. TYPE SPECIES: *Sabatia difformis* (L.) Druce.

The two species associated in this subsection are strongly differentiated morphologically from the annual species of subsection *Angulares* with which they were formerly placed. Including these perennials with the radically different species belonging to the *Angulares* would be placing undue emphasis upon the single character of an opposite-branching pattern that is typical of both groups while underestimating features such as the perennial habit and fleshy roots which seem to me to be of greater phyletic significance. The habitat occupied by the perennials is typically that of savannas and ditches, whereas the annuals of the *Angulares* are generally inhabitants of drier situations.

The three entities forming subsection *Difformes* are a conspicuous floristic feature of savannas or pine-barrens, or the marshy borders of low hardwood forests throughout their combined extensive range. These plants are, with the exception of a very few Piedmont stations at the outer margin of that province, entirely restricted to the Coastal Plain, ranging from central New Jersey southward throughout much of peninsular Florida and westward into Louisiana. The three populations do not possess mutually exclusive areas but occupy ranges in the nature of overlapping arcs somewhat radially arranged about what may have been the ancestral home of the group, the ancient Appalachian land-mass. It may be speculated that the original population, which was perhaps polymorphic,

³ Subsectio *Difformes*. Herbae perennes, rhizomatibus crassis, contortis, saepe multiramosis radicibus carnosis ca. 2 mm. diam. Rami plerumque oppositi. Folia in speciminibus siccis crasse chartacea, marginibus revolutis. Corolla alba. Species typica, *Sabatia difformis* (L.) Druce.

migrated from Appalachia onto the Coastal Plain. The fragments of the original population that reached the new home continued to evolve and to spread laterally along the Coastal Plain. When they had reestablished partial contact with their close relatives, genetical and other barriers had developed which maintained the identity of the three entities.

KEY TO THE SPECIES OF SUBSECTION DIFFORMES

- Leaves and upper portion of the stem not glaucous; calyx-lobes typically more than 4 mm. long and often 10 mm. long or longer; upper bractlets linear, those subtending complete (i.e. 3-flowered) cymules 4–5 mm. or more in length; corolla-lobes almost invariably longer than 7 mm. and often up to 15 mm. and occasionally longer, their color often turning saffron or orange upon drying, especially along the veins; plants rarely taller than 9 dm. high; the main stem and branches becoming strongly angled or even quadrate above from 4 internodal ridges; ranging from central New Jersey southward and westward into western Florida.....1. *S. difformis*.
- Leaves and upper portion of the stem glaucous; calyx-lobes rarely as long as 3 mm.; upper bractlets minutely scale-like, even those subtending complete cymules less than 3 mm. long; corolla-lobes 4–7 mm. long, color remaining white or creamy-white upon drying; plants more robust, mostly taller than 9 dm.; the main stem and branches terete throughout, not becoming angled or quadrate; ranging from central Georgia and ne. Florida westward into Louisiana.....2. *S. macrophylla*.

1. ***Sabatia difformis*** (L.) Druce *Swertia difformis* L., Sp. Pl. 1: 226. 1753. *Chironia lanceolata* Walt., Fl. Car. 95. 1788. *C. cymosa* Lam., Tabl. Encyc. et Méth. Bot. 1: 479. 1791, not Burm., Fl. Cap. 5: 1768. *C. paniculata* Michx., Fl. Bor.-Am. 1: 146. 1803. *C. venosa* Muhl., Cat. Pl. Am. Sept. 24. 1813. *Sabatia paniculata* (Michx.) Pursh, Fl. Am. Sept. 1: 138. 1814. *S. paniculata* α *latifolia* Pursh, l.c. *S. paniculata* β *angustifolia* Pursh, l.c. *S. corymbosa* Baldw. ex Ell., Sk. Bot. S. C. & Ga. 1: 283. 1817. *S. corymbosa* var. *angustifolia* Ell., l.c. *S. lanceol.* [lanceolata Walt.] Raf., Fl. Tell. 3: 30. 1837, without basionym. *S. cymosa* [Lam.] Raf., l.c. without basionym. *S. cymosa* (Lam.) G. Don, Gen. Hist. 4: 207. 1838, as to basionym only. *S. lanceolata* (Walt.) T. & G., Man. ed. 1. 356. 1848. *S. difformis* (L.) Druce, Bot. Exch. Club & Soc. Brit. Is. 3: 423. 1914, as to basionym only.

Perennial herb (25–)45–80(–105) cm. tall, 2–5 mm. in diameter, 1–several stems arising in a cluster from a gnarled, stout, branched rhizome 4–6 mm. in diameter. Stem stiffly erect, hollow, more or less terete below, becoming angular and sometimes almost quadrate above from the internodal ridges. Branches typically opposite, occasionally alternate at some nodes, ascendent at an angle of (10–)20–40(–50) degrees, generally restricted to the upper tenth or third of the stem, or less commonly in very robust plants branching almost throughout the entire length of the stem. Principal branches typically 3–4-times branched and together forming a compact, corymbose, flat-topped to convex

inflorescence. Numerous fleshy roots descending from the rhizome, these 8–12(–20) cm. long, 1.5–3 mm. in diameter, usually bearing slender, fibrous, lateral roots. Leaves thick, rather succulent, drying somewhat thick-chartaceous, venation obscure except for the rather prominently elevated midvein and often the lateral pair of veins, or in the broader-leaved types with 2 lateral pairs prominent. Basal rosette none; the lowermost cauline leaves borne submerged or subterranean, at time of flowering usually represented only by scars, but when still present, often modified into appressed, obtuse, oblong bracts 2–3 cm. long. Upper cauline leaves strongly ascendent, linear to lanceolate or even somewhat oblong or ovate-lanceolate to strongly ovate (especially in peninsular Florida), usually acute, rarely obtuse, somewhat revolute and both scarious-margined and -tipped, usually rather strongly clasping, or merely sessile in the narrower leaved types, (0.9–)1.8–4(–6.2) cm. long, (3–)4–14(–22) mm. wide, usually not more than twice exceeded by the internodes and usually less; internodes occasionally 3–5 times or more longer than the nearby leaves. Pedicels slender, erect, finely ridged, 2–8(–15) mm. long. Calyx-tube only slightly ridged, rather shallowly campanulate, crateriform or even turbinate, 1–2(–3) mm. long; calyx-lobes linear to somewhat subulate, very slender, (2–)4–10(–14) mm. long, 2–8(–10) times the length of the tube, more or less outwardly arching at anthesis, erect in bud. Corolla-tube narrowly cylindrical, (2.5–)3–5(–6) mm. long; corolla-lobes typically 5, (the centermost flower of the central cymules often 6-parted), oblong, weakly spatulate, elliptic, obtuse to acute, wide-spreading, (5–)7–15(–21) mm. long, 2.5–6(–8) mm. wide, entirely white even at the base, but often turning orange or saffron upon drying, especially along the veins. Filaments 2–3 mm. long, pale-yellowish to almost white, slender; anthers slender, lanceolate, bright yellow, 2–3 mm. long. Style 2–5 mm. long; stigmatic lobes slender, linear, 2–5 mm. long. Capsule oblong-cylindrical, 4–8 mm. long, 2.5–4 mm. wide. TYPE LOCALITY: "In Virginia." TYPE: *Clayton 171* (British Museum); photograph of the type (GH!). DISTRIBUTION: Savannas and pine-barrens along the Coastal Plain from (perhaps Long Island) central New Jersey southward throughout much of peninsular Florida and westward into western Florida. Map. 1.

The only species with which *S. difformis* might be confused is *S. macrophylla*, which belongs to the same subsection and which shares with it the distinctive features of a stout, gnarled rhizome bearing numerous, thick, fleshy roots, characteristically opposite branches, thick leaves and white 5(6)-parted corollas. However, *S. difformis* may be readily distinguished from *S. macrophylla* by numerous striking differences among which are the absence of a glaucous bloom, the almost invariably longer calyx-lobes, bractlets, and corolla-lobes; the very common change of color to orange or saffron upon drying, the stem angled

or quadrate above, and the typically smaller stature. The ranges of the two species overlap in Georgia and in Florida; but throughout the main part of the area occupied, they are not compatriots. (See Maps 1 and 2)

S. difformis and another typically white-flowered, opposite-branched species, here called *S. quadrangula* but referred to by recent authors as *S. paniculata*, have been closely associated together in many treatments of the genus and often the two are misidentified. Gleason's (1952) account of the species that has been passing as *S. paniculata* fails to distinguish clearly the two species. *S. paniculata*, according to Gleason, is "similar to *S. difformis* in habit, stature, and inflorescence" and is "very close to *S. difformis* in describable characters . . ." The two species may be easily distinguished and the differences are such that I feel that the two belong to different species-groups. The features of *S. difformis* mentioned in the preceding paragraph are in strong contrast to those of the other species which is a rosulate annual with a strongly 4-sided stem and membranous leaves.

The synonymy of this species is extensive and there has been much confusion and misunderstanding throughout the literature regarding these names. It therefore seems advisable to discuss each synonym briefly.

Swertia difformis L. is based upon the Gronovian "*Gentiana foliis linearibus acuminatis, pedunculis, longissimis nudis unifloris oppositis*" which in turn rested upon Clayton's collection 171 and also apparently two other specimens or perhaps descriptions sent by Clayton. These last two references apparently played no part in Linnaeus' concept and it is very unlikely that they entered to any extent into that of Gronovius as they presented characteristics that were in direct contrast to those described in the principal account. They certainly both belonged to at least a different species. The specimen in Clayton's herbarium is, as is shown by the photograph in the Gray Herbarium or by Blake's sketch (*Rhodora* 17: pl. 112. 1915.), the uppermost portion of the rhizomatous perennial possessing characteristically opposite branches and a white, 5(6)-parted corolla. The specimen is peculiar in that the lateral branches, all six of them, are very much elongated and bear but one flower each. The

inflorescence hence is very loose. The terminal flower is six-parted and this feature is shown very clearly in the photograph. The original description little suggests the plant that it is now known to depict and it is therefore not surprising that its proper disposition was but so recently accepted by most American botanists. The diagnosis, however, is excellent as a description of the somewhat atypical type specimen which is the opposite-branched perennial which was known throughout the latter half of the nineteenth century as *S. lanceolata*. Druce, in transferring the epithet, referred it to what has been called *S. elliottii*, an alternate-branched, white-flowered annual. In this he was following either the "Synoptical Flora" or the "Index Kewensis." Clayton's specimen has nothing to do with that species. The alternate-branched annual, furthermore, has not been found north of South Carolina; the opposite-branched perennial is known from southeastern Virginia, where Clayton served as a clerk of the court of Gloucester County for many years.

Card (Ann. Mo. Bot. Gard. **18**: 262. 1931.) in his monograph of *Frasera* listed *Swertia difformis* as a synonym of *Frasera caroliniensis* Walt. This mistake has been previously and emphatically pointed out by St. John (Am. Midl. Nat. **26**: 5. 1941.). Card was no doubt following Rafinesque (Med. Fl. **1**: 196. 1828.) who listed this name among others as being synonymous with his substitute name, *F. verticillata*. Merrill (1949) also equates *Frasera verticillata* in part to *Sabatia difformis*.

Of the seven fragmentary specimens of *Sabatia* still represented in Walter's collection two match the brief description of *Chironia lanceolata* and are certainly referable to the opposite-branched perennial. The association of Walter's name with the perennial has been almost invariably the rule from the time of Pursh (1814), who, as stated in his Preface, had examined Walter's collection. The combination of Walter's epithet with *Sabatia* can perhaps first be credited to Torrey and Gray in Gray's Manual (1848) who, after describing the plant, listed *S. corymbosa* Ell. as a synonym. The only name listed in synonymy under *S. corymbosa*, when it was originally described, was Walter's *Chironia lanceolata*. The synonymy of this species presented by Grisebach (1839, 1845) was complete and these accounts were doubtless

the basis for Gray's treatment. It is to be remembered that Gray also examined Walter's collection in 1839.

Rafinesque (Fl. Tell. 3: 30. 1837.) may have intended this transfer when he listed "*lanceol.*" in an enumeration of the genus *Sabatia*. Many of the names in this list were never described as the promised monograph never appeared. For *S. lanceolata* (as *lanceol.*), there were no basionym or description so even listing the name in synonymy may not be warranted.

A photograph of the type of *Chironia cymosa* Lam., which is located in Paris, was lent by the Gray Herbarium and it also proves to be a specimen of *S. difformis*. The specimen as is shown by the label was one of Fraser's from "eastern [South] Carolina."

Rafinesque (Fl. Tell. 3: 30. 1837.) in the same list of names in which "*lanceol.*" appears, also included *cymosa* and again without basionym or description. It is possible that a transfer was intended.

This epithet, *cymosa*, was transferred formally by G. Don (1838) with the necessary basionym. The description that accompanies the name, however, applies only to *S. quadrangula*, a very different species.

Chironia paniculata Michx. is discussed more fully under *S. quadrangula*, a species with which it has long been confused. The original description was brief and the few clues presented there have been either overlooked or misunderstood. The species was known to Michaux from Georgia and "Carolina." The photograph at the Gray Herbarium of the collection in Michaux's herbarium labeled "*Chironia paniculata* Georgia," illustrates an excellent specimen and one which is unmistakably *S. difformis*. Pursh transferred Michaux's epithet to *Sabatia* and noted the synonymy with both *Swertia difformis* and *Chironia lanceolata*. He had seen the specimen upon which *Swertia difformis* is based in Bank's herbarium and was acquainted with authentic material of Walter's species. In addition Pursh designated two varieties, which, as I interpret the descriptions, are merely the broad- and narrow-leaved variations that are common among representatives of this species. However, Gray (1878) and following him Blake (1915) considered *Chironia paniculata* β *angustifolia* to be, excluding *C. lanceolata* listed in synonymy by Pursh, what is here called *S. quadrangula*.

Chironia venosa Muhl. was relegated to the synonymy of the opposite-branched, white-flowered perennial by Torrey as early as 1824. Those names published for the first time in Muhlenberg's Catalogue are so briefly characterized that Merrill and Hu (*Bartonia* No. 25: 22. 1949) stated that they should be considered as *nomina nuda* unless a basionym were included. The information presented with *Chironia venosa* was that the corolla was white and veiny and that the plant was a perennial found in "N. Caes. Ten." *S. difformis* is not known from Tennessee, nor is any other perennial or any other typically white-flowered species. It is found in New Jersey (N. Caes.). Otherwise there can be but little doubt that *Chironia venosa* is the same as *S. difformis*. The specific epithet aptly describes the orange discoloration especially noticeable along veins of the corolla-lobes in some dried specimens.

Sabbatia corymbosa Baldw. ex Ell. is the last of the new names proposed for the white-flowered, rhizomatose perennial. Authentic specimens from Elliott's herbarium prove the correctness of treating this name as a synonym of *S. difformis*. This sheet apparently bears two collections, which may be taken perhaps as types; one with ovate leaves apparently representing the typical element and the other with narrower leaves, probably a representative of his *S. corymbosa* var. *angustifolia*. This specific name was generally employed in designating the perennial species until the combination of *S. lanceolata* was made in 1848.

REPRESENTATIVE SPECIMENS:—NEW YORK: Nassau Co., Hempstead Flats, *Mackanness*, 1937 (NO). Since no other specimen of this species has been seen or has been reported from the state and since the region is rather well-known botanically, error in labeling is suspected. NEW JERSEY: Burlington Co., about 1.5 mi. se. of Atsion, *Fogg* 5663 (F, GH, PENN); Ocean Co., Tom's River, *Mackenzie* 2774 (MO, US). DELAWARE: Sussex Co., 0.5 mi. w. of Concord, *Tatnall* 3129 (GH). MARYLAND: Worcester Co., Stockton, *Rusby*, Aug. 1889 (NY). VIRGINIA: Sussex Co., sw. of Wakefield, *Fernald, Long & Clement* 15340 (GH, MO, US). NORTH CAROLINA: Bladen Co., 4 mi. n. of Elizabethtown, *Wilbur* 2900 (MICH); Harnett Co., about 3 mi. se. of Dunn, *Wilbur* 2897 (MICH); New Hanover Co., Carolina Beach, *Godfrey*, PL. EX. GRAYANAE 974 (F, GA, GH, MICH, MO, MT, NCS, NCU, NY, OKL, PENN, SMU, TENN, TEX, WIS, WVA, US). SOUTH CAROLINA: Berkeley Co., about 6 mi. ne. of Summerville, *Wilbur & Webster* 2854 (MICH); Georgetown Co., 12 mi. n. of Georgetown, *Godfrey & Tryon* 65 (DUKE, F, GH, MO, NY, PENN, TENN, US). GEORGIA: Charlton Co., below Trader's Hill, *Small*, 12–15 June 1895 (F, NY); McIntosh Co., 1.5 mi. n. of Darien, *Cronquist* 5375 (GA, US) Thomas Co., about 1 mi.

n. of Coolidge, *Duncan 8468* (FLAS, GA, MO). FLORIDA: Dade Co., Biscayne Bay, *Rusby* (MICH) [Since otherwise not known south of Lake Okeechobee, this station seems questionable.] Highlands Co., near Sebring, *Small, Small & Dewinkeler*, 17 July 1924 (FLAS, GH, NY, US); Lake Co., Eustis, *Nash 849* (CU, F, GH, MICH, MO, MT, NY, US); Manatee Co., Bradentown, *Tracy 7541* (CU, F, GH, MO, NY, US, WIS); Okaloosa Co., 4 mi. e. of Crestview, *Webster & Wilbur 3592* (MICH); Polk Co., 16 mi. sw. of Kissimmee, *Wilbur & Webster 2637* (MICH); Santa Rosa Co., e. bank of Blackwater River across from the town of Milton, *Webster & Wilbur 3579* (MICH); Walton Co., near DeFuniak Springs, *Curtiss 5906* (CU, F, FLAS, GH, KSC, NCU, NY, SMU, US); Washington Co., 1 mi. e. of Caryville, *Webster & Wilbur 3601* (MICH).

2. ***Sabatia macrophylla*** Hook., *Compan. Bot. Mag.* 1: 171. 1836.

Perennial herb (50–)90–120(–140) cm. high, 2–7 mm. in diameter, usually with several stems arising in a cluster from a stout, gnarled, branched rhizome up to 1 cm. in diameter and often 10 cm. or more in length. Stem stiffly erect, hollow, terete throughout, without ridges or fine lines extending between the nodes, strikingly glaucous above. Numerous white to reddish-brown fleshy roots often 15 cm. or more in length and about 2 mm. in diameter descending in clusters from the rhizome with occasional slender, fibrous, lateral roots. Branches typically opposite, very rarely alternate, generally restricted to the upper tenth or quarter or, more rarely, throughout the upper half of the stem, ascendent to rather strongly divergent forming an angle of 15–60 degrees with the stem, producing a compact, corymbose, flat-topped to somewhat convex inflorescence. Leaves thick, somewhat succulent, drying thickly chartaceous, strongly ascendent, very noticeably glaucous when fresh, ovate-lanceolate, lanceolate (sometimes very narrowly so), oblong, to ovate-oblong or even ovate, acute or rarely obtuse, scarious-mucronate tipped, margins conspicuously scarious and often slightly revolute, strongly clasping, (2.5–)3–6(–8.5) cm. long, (0.5–)1–2.5(–4.5) cm. wide, midvein prominently elevated beneath, 1–2 pairs lateral veins also often rather conspicuous. Basal rosette none; the lowermost cauline leaves absent at time of flowering. Internodes typically 3–5 times the length of the leaves. Inflorescence of numerous cymules corymbosely arranged forming a compact flat-topped to somewhat convex cluster. Leaves within the inflorescence abruptly reduced to acute, scale-like, usually non-chlorophyllous bracts 1–4 mm. long, the ultimate bracts less than 2 mm. long; the flowering clusters thus appearing naked. Pedicels slender, erect or ascendent, 1–5 mm. long. Calyx-tube and lobes more or less colorless, non-chlorophyllous; the tube campanulate, scarcely ridged or lined by elevated vascular traces, 1–2 mm. long; the lobes triangular-dentate, subulate, or linear, erect, slightly spreading, or somewhat outwardly curved at the tip, or strongly recurved, (0.1–)0.2–2.5(–3.0) mm. long, 0.1–3.5 times the length of the calyx-tube. Corolla-tube narrowly cylindrical, white, (2–)3–3.5(–4) mm. long. Corolla-lobes oblong to oblong-spatulate, obtuse, widely spreading at anthesis, (4–)5–7(–8) mm. long, 2–3(4) mm. wide, entirely white or creamy-white, color not changing, or

changing but little, upon drying. Filaments (1.5-)3-4 mm. long, white; anthers slender, lanceolate, creamy white to pale yellow, 1-2 mm. long. Style 1-3 mm. long; stigmatic lobes slender, 1-3 mm. long. Capsule globose or nearly so to ovoid, (3-)3.5-4(-4.5) mm. high, (2-)3-4 mm. wide.

Small (1933) described *S. recurvans* and, according to him, this species differed from *S. macrophylla* by the characteristics presented below.

<i>S. macrophylla</i> Hook.	<i>S. recurvans</i> Small
Calyx 2-3 mm. long, lobes shorter than the tube.	Calyx 4-5 mm. long, lobes longer than the tube.
Corolla-lobes 6-8 mm. long.	Corolla-lobes 5-6.5 mm. long.
Capsule 3-4 mm. long.	Capsule 3.5-4.5 mm. long.
Style and stigma about equal in length.	Style much shorter than the stigma.

Available to Small at New York were five sheets which here are considered part of the *recurvans* population. Two of these, *Harper 1415* and *708*, were so annotated by Small. Excellent specimens of Harper's *1415* are represented in several herbaria. The specimen of this number at New York is chosen as the lectotype. It, however, lacks fruit, which was described from Harper's *708*.

The specimens of *S. recurvans* available to Small at New York were too few to be significant in evaluating the supposedly distinguishing characters. This is especially true in regard to the overlapping size-ranges of the corolla-lobes and capsules published as additional evidence. These overlapping ranges might be of some significance if based upon a large series of specimens but in this case furnished only "padding" to an otherwise scantily characterized entity. Even now few fruiting specimens are available but measurements of them indicate a range of 3-4.5 mm. in length of capsule in both species. The length of the corolla-lobes is equally useless as a distinguishing feature as the range of *S. macrophylla* was between 4-8 mm. and that of *S. recurvans* between 4-7 mm. The slight discrepancy would very likely disappear if a larger series of measurements were made. The length of the corolla-lobes is apparently strongly affected by environmental conditions and the season in which the flowers are produced. Flowers developing later in the season are generally much smaller than those appearing earlier in the year. Therefore, all of the characters with over-

lapping ranges presented by Small as supporting evidence of the distinctiveness of the two entities prove completely useless upon examination of more collections.

The ratio of the style to the stigmas was indicated by Small to be a reliable distinguishing feature. It was even used by him as a secondary key-character. However, the comparative length of these structures varies enough so that one may find either the stigma or the style longer on the same plant; consequently this character is not of taxonomic value. The comparative length of the stigma to the style varies considerably in different stages of maturity.

The calyx does possess features which seem to be valid; specimens can be assigned to one group or the other by the calyx characters and the two groups thus delineated occupy, as far as is now known, adjacent but distinct areas. Small's very convenient hiatus of 1 mm. between the size-range of the calyx in the two entities disappears upon examination of a number of flowers. The overall calyx-length of *S. macrophylla* is 1.1–3(–4) mm., while that of *S. recurvans* is (2–)2.5–4.0(–4.5) mm. long. The overlap of these ranges is too great to be of much aid in identification.

A comparison of the length of the calyx-lobes has much more promise, but that, too, fails to provide a clear-cut distinction that might be mechanically applied. The *macrophylla*-population has lobes (0.1–)0.2–1.2(–2) mm. long. Of the more than six hundred lobes measured in this group nearly sixty per cent were less than 1 mm. long, and over ninety-six per cent of the lobes were less than 1.2 mm. long. The few flowers with calyx-lobes longer than 1.2 mm. were always the centermost flower of the inflorescence or the oldest flower of the cymules closest the center of the compound inflorescence. Their lobes are often longer than those of other flowers on the same plant. Calyx-lobes of the *recurvans*-group measured (1–)1.5–3 mm. long with only five flowers (less than three per cent of the total) with lobes less than 1.5 mm. long and with more than seventy per cent of the nearly two hundred lobes measured 2 mm. long or longer.

The ratio of the lobe/tube-length provides a somewhat sharper means of separation but even this provides no clear-

cut division between the two populations. This ratio-range of the *macrophylla*-group is (0.1-)0.2-1(-2) with all but five flowers possessing lobes equaling or less than the tube in length. These few flowers were again the centermost which are often strikingly different from the others in the inflorescence. The same ratio-range in the *recurvans*-population is (1-)1.3-3(-3.5) with only four flowers (2.3 per cent) equaling the tube and nearly forty per cent of the flowers possessing lobes two or more times greater than the tube.

Even the feature of the recurved lobes is not restricted to the *recurvans*-group; some of the longer-lobed representatives of *S. macrophylla*, which are found in the extreme eastern portion of its range, show at least the beginnings of this tendency by possessing lobes slightly recurved at the extreme tip.

The most useful criterion known to me for the separation of the two populations is that based upon the length of the calyx-lobes. Future study may demonstrate that the group known as *S. macrophylla* possesses pronounced clinal variation from west to east and that this variation is in the direction of the even more easterly population previously known as *S. recurvans*. The calycine lobes of the plants from western Florida seem longer on the average than those from Louisiana. The even more eastern *S. difformis*, the species most closely related to the above-discussed complex, is usually readily distinguished by calyx-lobes which are almost invariably longer than even those of *S. recurvans*. Again in regard to characters of the calyx there is no sharp separation between the two populations but the upper limits of *S. recurvans* overlap but slightly the relatively few calyx-lobes measured in *S. difformis* which were shorter than 4 mm. long.

The material at hand may be readily assigned to one population or the other with little more than a glance at several calyces and the two groups have, as far as is now known, separate ranges. The two entities, here considered to represent weakly differentiated geographical varieties, are not distinguished by strong, or even exclusively delimiting morphological characters. Nor are the two varieties widely separated geographically as they are now known to occur at least within fifty miles of one another.

KEY TO THE VARIETIES

Calyx-lobes erect or only slightly outwardly curved at the tip, equaling or less than the calyx-tube in length. 2a. *S. macrophylla* var. *macrophylla*.
 Calyx-lobes strongly recurved, exceeding the calyx-tube in length.

2b. *S. macrophylla* var. *recurvans*.

2a. *Sabatia macrophylla* Hook., var. **macrophylla**.

Calyx lobes (0.1–)0.2–1.5(–2) mm. long, triangular-dentate to linear, erect or only slightly outwardly curved at the tip, equaling or less than the calyx-tube in length (very rarely the centermost flower of the central cymules may have a ratio of lobe/tube greater than 1). TYPE LOCALITY: near Covington, Louisiana. Type: *Drummond s. n.* (K!). DISTRIBUTION: Savannas and pine-barrens and margins of low hardwoods from western Florida and Georgia westward to Louisiana. Map 2.

REPRESENTATIVE SPECIMENS:—GEORGIA: Muscogee Co., Columbus, *Boykin* (BRU, GH, NY); Sumter Co., Americus, *Harper*, 30 July 1897 (GH). FLORIDA: Bay Co., 1 mi. n. of Lynn Haven, *Webster & Wilbur 3626* (MICH); Calhoun Co., 2 mi. s. of Chipola, *Thorne & Muenscher 8744* (CU); Columbia Co., Lake City, collector not stated (F); Escambia Co., 9 mi. w. of Pensacola, *Webster & Wilbur 3575* (MICH); Franklin Co., Apalachicola, *Biltmore Distrib. Chapman Herb. 4508a* (GH, NY); Gadsen Co., inter Quincy et Aspalga, *Rugel*, July 1843 (MO, NY); Gulf Co., Port St. Joe, *Knight*, 18 June 1936 (FLAS); Liberty Co., Bristol, *West & Arnold*, 23 July 1940 (FLAS); Okaloosa Co., about 3 mi. e. of Crestview, *Webster & Wilbur 3584* (MICH); Wakulla Co., 1.5 mi. s. of Sopchoppy, *Webster & Wilbur 3628* (MICH); Walton Co., near Argyle, *Curtiss 5931* (CU, FLAS, GH, KSC, MO, NCU, NY, SMU, US); Washington Co., 8 mi. s. of Chipley, *Webster & Wilbur 3614* (MICH). ALABAMA: Baldwin Co., 13.5 mi. w. of Foley, *Webster & Wilbur 3530* (MICH); Mobile Co., about 8 mi. w. of Mobile, *Webster & Wilbur 3481* (MICH); Washington Co., 40 mi. n. of Mobile, *Sargent*, 18 June 1950 (GA, NCS). MISSISSIPPI: Forest Co., Lake Shelby State Park about 14 mi. s. of Hattiesburg, *Webster & Wilbur 3402* (MICH); Harrison Co., Biloxi, *Tracy 7006* (F, MO, NY, US); Jackson Co., Ocean Springs, *Pollard 1064* (CU, F, MO, NY, US); Perry Co., 9 mi. n. of Beaumont, *Webster & Wilbur 3422* (MICH); Stone Co., 3 mi. s. of Wiggins, *Webster & Wilbur 3439* (MICH). LOUISIANA: St. Tammany Parish, Covington, *Drummond* TYPE (K).

2b. *Sabatia macrophylla* Hook., var. **recurvans** (Small) comb. nov.
Sabbatia recurvans Small, Man. SE Fl. 1049. 1933.

Calyx-lobes (1–)1.5–3 mm. long, linear to subulate, strongly recurved, typically exceeding the calyx-tube in length (less than 3 per cent of the nearly 200 lobes measured had a lobe/tube ratio of 1 or 1.2). LECTOTYPE LOCALITY: Moist pine-barrens east of Ocilla, Irwin Co., Georgia. Lectotype: *Harper 1415* (NY!). DISTRIBUTION: Savannas and pine-barrens of southern Georgia and northeastern Florida. Map 2.

REPRESENTATIVE SPECIMENS:—GEORGIA: Brantley Co., 3 mi. e. of Nahunta, *Wilbur & Webster 2748* (MICH); Charlton Co., 8 mi. s. of Folkston, *Wright 881* (CU); Coffee Co. without exact locality, *Harper 708* (NY, US); Emanuel Co., e. of Swainsboro, *Duncan 2677* (MICH); Irwin Co., e. of Ocilla, *Harper 1415* (F, GH, MO, NY, US); Laurens Co., 10 mi. e. of Dublin, *Pyron & McVaugh 750*

(GA, US); Worth Co., 3.5 mi. w. of Sylvester, *Thorne 6363* (CU). FLORIDA: Baker Co., without exact locality, *Curtiss 2224* (CU, F, MO, NY, US, YU); Clay Co., without exact locality, *Todsen*, 30 July 1939 (FLAS); Duval Co., 15 mi. w. of Jacksonville, *Wiegand & Manning 2566* (CU, GH); Nassau Co., without exact locality, *Knight*, 1 July 1941 (FLAS).

(B) Subsection ANGULARES Blake, *Rhodora* 17: 56. 1915.

Annuals with fibrous roots and with typically opposite branches. Leaves thin and membranous, margins not scarious. Basal rosette usually well-developed at some time during maturation of plant. TYPE SPECIES: *Sabatia angularis* (L.) Pursh.

The three species comprising subsection Angulares, as here defined, are readily distinguished from one another. As a group it is strongly differentiated from all other subsections of section *Eusabatia*. The annual habit separates them from subsections *Difformes* and *Dodecandrae*, the opposite branches and the typically 3-flowered cymules set them apart from the *Campanulatae*, and the thin, merely finely ridged calyx-tube and, again, the opposite branches easily distinguish the *Angulares* from the *Campestres*. This subsection occupies the largest area of any within the genus.

These three species and the other species reported as annuals in the paper have most often in the past been treated as biennials. Field observations and limited experience with some of the species in the greenhouse has led me to believe that they are all probably annuals but this point has not been definitely established.

KEY TO THE SPECIES OF SUBSECTION ANGULARES

- A. Lower portion of the stem strongly 4-angled, quadrate, the corners with conspicuous membranously-winged margins.
- B. Corolla pink to roseate (very rarely white); pedicels elongate, 1 cm. or more in length; lower cauline leaves usually broadly ovate to ovate-lanceolate, usually less than 3 times as long as broad; calyx-lobes usually 1.5 mm. or more in width (rarely as narrow as 1 mm.).
3. *S. angularis*.
- B. Corolla white; pedicels short, less than 5 mm. long; lower cauline leaves usually oblong, generally 4 or more times as long as broad; calyx-lobes less than 0.5 mm. wide 4. *S. quadrangula*.
- A. Lower portion of the stem terete and not bearing thin membranous wings.
5. *S. brachiata*.

3. ***Sabatia angularis*** (L.) Pursh *Chironia angularis* L., Sp. Pl. 1: 190. 1753. *C. angularis* var. *α latifolia* Michx., Fl. Bor.-Am. 1: 147. 1803. *Sabbatia angularis* (L.) Pursh, Fl. Am. Sept. 1: 137. 1814. *S. angularis*

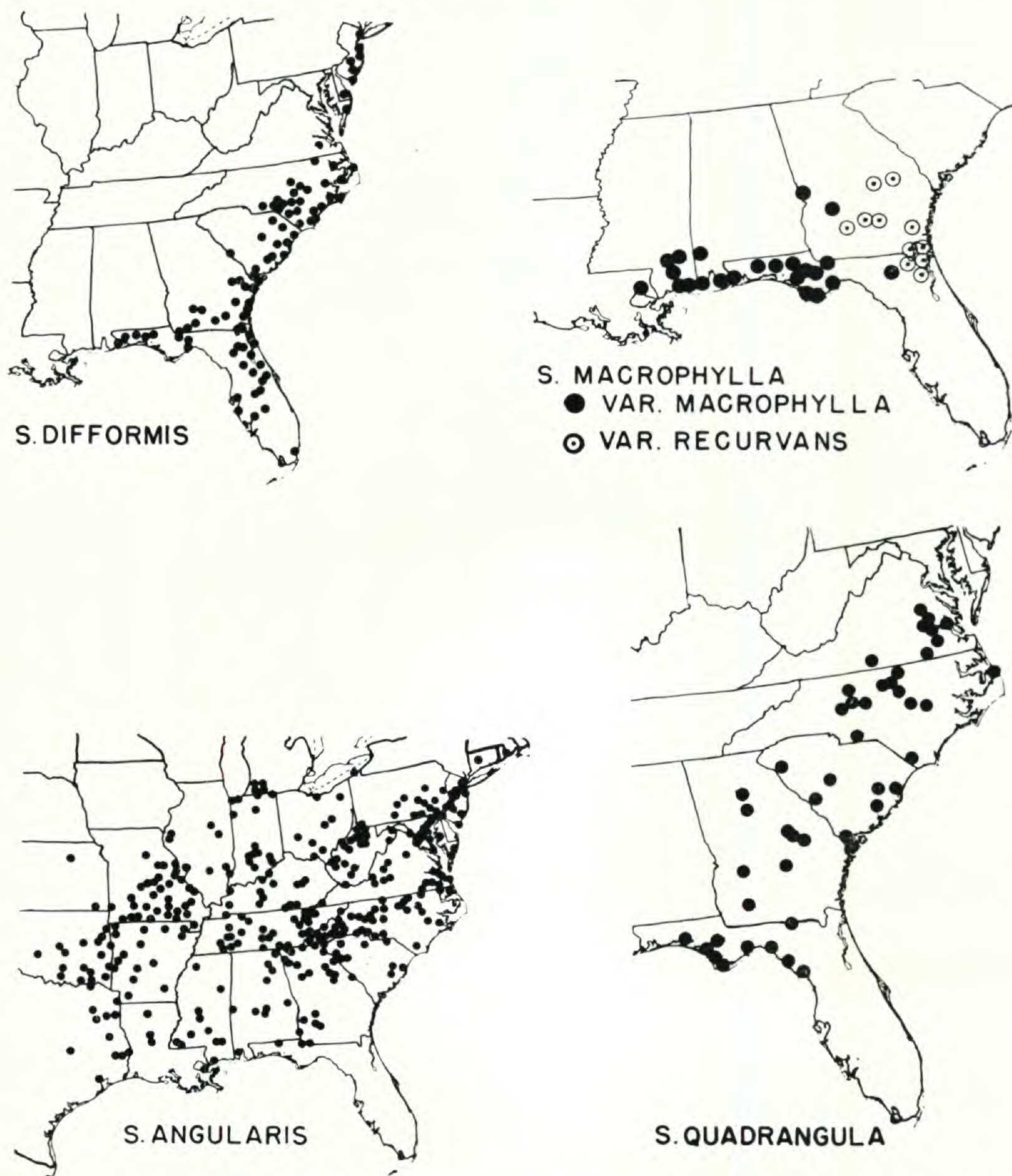
var. *albiflora* Raf., Med. Fl. 2: 77. 1830. *nom. nud.* *S. angularis*, var. *elatior* Raf., *l.c.*, *nom nud.* *S. angularis*, var. *latifolia* Raf., *l.c.*, *nom nud.* *S. angularis*, var. *pauciflora* Raf., *l. c.*, *nom nud.* *S. angularis*, f. *albiflora* Raf. ex House, Bull. N. Y. State Mus. 254: 566. 1924. *S. angularis* f. *cleistantha* Fern., RHODORA 42: 474. 1940.

Erect annual (15-)30-50(-90) cm. tall, often robust and usually with the numerous branches presenting in plants developed under favorable conditions a bushily compact aspect. Stem strongly tetragonal, hollow, the corners conspicuously wing-angled by thin membranous extensions 0.1-0.5 mm. wide. Stem green in younger portion becoming yellowish straw-colored below, (1-)2-3(5) mm. in diameter. Branches typically opposite, although ultimate-branching often alternate, usually by marked abortion of opposing bud, or generally alternate in depauperate plants, often numerous, rarely extending to base, but more typically restricted to upper third or half of stem, rather closely ascendent forming an angle of about 20-45 degrees with main stem. Branches composed of 1-10 nodes in well-developed plants and forming a convexly-corymbose or pyramidal compact crown. Roots several, fibrous, 4-10(-20) cm. long, (0.2-)1-3(-4) mm. in diameter, wide-spreading and usually shallowly situated. Leaves thin membranous, spreading to ascendent, drying thin, 5-7-nerved or fewer in those leaves transitional to bracts, (1-)2-3.5 (-4.5) cm long, (0.8-)1-2.5(-3.5) cm. wide, venation prominently elevated beneath. Basal rosette rarely present at anthesis, composed of spreading, shortly-spatulate, broadly oblong to obovate, obtuse leaves up to about 4 cm. long and often 2-3 cm. wide. Lowermost cauline leaves usually absent at time of flowering, the lowest usually broadly ovate, always strongly clasping, obtuse, typically nearly as broad as long, the middle narrower, more typically ovate-lanceolate, obtuse or more commonly acute, and gradually reduced and modified above to the 1-nerved linear bracts. Internodes generally about 1.5-3 times as long as the leaves. Inflorescence of corymbosely- or pyramidally-arranged cymules, either or both of the lateral branches sometimes suppressed. Pedicel 5-sided, slightly wing-angled, (1-)2-3.5(-4.5) cm. long, erect or strongly ascendent. Calyx-tube thin, shallow, 2-5 times exceeded by the corolla-tube, usually about 1.5 mm. long (1-2 mm.), with venation somewhat elevated. Calyx-lobes thin, narrowly linear, linear-oblong, to somewhat foliaceous, usually about 1 cm. long (0.4-1.5 cm.) and (1-)1.5-2.5(-3.5) mm. wide, ascendent in bud, wide-spreading at anthesis, usually exceeded by the corolla by 5-12 mm. Corolla-tube 4-7 mm. long, 2-4 mm. in diameter, cylindrical, pale greenish-white within and without. Corolla-lobes oblong, spatulate, or elliptic, obtuse, wide-spreading, (0.6-)1-1.8(-2.2) cm. long, (2-)4-7(-9) mm. wide, greenish in bud turning white prior to full development and typically pink or roseate at anthesis or rarely white, coloration paler beneath, with an irregular, somewhat pointed, yellow or greenish-yellow area at base of lobe and in throat and usually bordered by a dark-red line. Filaments 2.5-4.5 mm. long, greenish-yellow to pale-yellow; anthers slender, bright yellow, 3-5 mm. long. Stig-

matic lobes very slender, 3–6 mm. long. Style 4–6 mm. long, usually somewhat less than length of stigmatic branches. Capsule cylindrical at maturity 5–9 mm. high, 4–6 mm. wide. TYPE LOCALITY: "In Virginia." Type: *Kalm* (in the Linnean Herbarium), but not seen. DISTRIBUTION: Margins of woods, fields, and prairies from southern New York south to northern Florida and west to Illinois and Texas. Occasionally introduced in Massachusetts and Connecticut. Map 3.

This species is by far the most familiar representative of the genus because of its wide range, the greatest of any in the genus, and also because of the frequency with which it is encountered throughout most of that range. The characteristic features are the conspicuous tetragonal stem, the corners of which are strikingly membranously wing-margined; the typically opposite pattern of branching, the ovate-clasping leaves, the roseate corolla (although albinos are encountered rather rarely), and the shallow calyx-tube, the venation of which, although often slightly elevated, is not developed into a heavy costa. None of these characters alone is enough to distinguish the species but the combination of them in one plant is unique. In the western part of the range of *S. angularis*, it has been confused surprisingly often with *S. campestris*. This latter species may be readily distinguished from the former by its typically alternate branching-pattern and especially by the turbinate and comparatively long calyx-tube with strongly developed costae. In the southeastern region, it has been confused at times with *S. brachiata*, but is at once separable from that species which possesses an almost terete stem and oblong, non-clasping leaves.

The species is remarkably uniform throughout its range. None of the trivial variants designated previously is here deemed worthy of recognition nor have any others been discovered. Although I have not seen even a photograph of the type of *Chironia angularis* β *angustifolia*, if it is still extant, I am accepting for the time being the past interpretation that this entity is what is now called *S. brachiata*. Coordinate with this variety, Michaux published *C. angularis* α *latifolia* which is perhaps the typical element of *S. angularis*. The species remained unencumbered by the designation of minor varieties until Rafinesque. This author, after discussing *S. angularis*, stated that "it has some varieties: 1. Albiflora, 2. Latifolia,



MAPS 1-4. Map 1, upper left; map 2, upper right; map 3, lower left; map 4, lower right.

3. Pauciflora, 4. Elatior." None of these propositions is discussed or mentioned by him further in any manner and hence are merely *nomina nuda*. Therefore, they are not available for transferral to any other rank. House, in providing formal nomenclature to designate the albino form, erred in transferring a name which "has no status under the Rules." For those who find it useful or satisfying to name such striking minor variations the epithet for the albino might best be written as *Sabatia angularis* forma *albiflora* House. Fernald described

a teratological specimen as *S. angularis* forma *cleistantha*. It has not been seen again in any of the many hundreds of sheets of this species that I have examined. The branches are stunted and malformed bearing sessile or nearly sessile flowers which are aborted and modified in size and form as to be scarcely recognizable as flowers. Little is to be gained by formal designation of such rare chance monstrosities.

REPRESENTATIVE SPECIMENS:—CONNECTICUT: Locality not stated, *Wright* (YU). NEW YORK: Richmond Co., near New Dorp, *Britton*, 9 Aug. 1879 (YU). NEW JERSEY: Cape May Co., Cold Spring, *Pennell 2128* (US). PENNSYLVANIA: Berks Co., 0.5 mi. wnw. of Gibraltar, *Berkheimer 2926* (GH, PENN). DELAWARE: New Castle Co., near Wilmington, *Canby*, Aug. 1878 (MO). MARYLAND: Harford Co., se. of Flintville, *Adams & Hopkins 923* (CU, PENN). DISTRICT OF COLUMBIA: Chain Bridge, *Earlanson & Martin 1210* (NA). VIRGINIA: Southampton Co., se. of Ivor, *Fernald & Long 10784* (GH, MO). NORTH CAROLINA: Buncombe Co., near Biltmore, *Biltmore Herb. 3303a* (F, GH, MO, NY, US); Durham Co., about 4 mi. ne. of Durham, *Wilbur 2898* (MICH); Halifax Co., Roanoke Rapids, *Godfrey 5178* (DUKE, GH, US). SOUTH CAROLINA: Williamsburg Co., 2 mi. ne. of Lane, *Godfrey & Tryon 399* (DUKE, F, GH, MO, NY, PENN, TENN). GEORGIA: Bartow Co., about 4.5 mi. s. 16° east of Allatoona Dam, *Duncan 8522* (FLAS, GA, GH, MO, TENN, US); Catoosa Co., 10 mi. w. of Ringgold, *Cronquist 5610* (GA, GH, US). FLORIDA: Jackson Co., Sneads, *Knight*, 29 June 1943 (FLAS). MICHIGAN: Kalamazoo Co., *Hermann 9042* (MICH). OHIO: Coshocton Co., near Coshocton, *Moldenke 13289* (OKLA, PENN, SMU). INDIANA: Morgan Co., about 2 mi. w. of Centerton, *Friesner 17008* (GH, NY, OKLA); Steuben Co., near Lake Gage, *Deam*, 11 Aug. 1903 (GH, US, WIS, YU). ILLINOIS: Marion Co., Salem, *Bebb 1860* (F, GH, YU). WEST VIRGINIA: Cabell Co., overlooking Roland Park, *Gilbert 778* (DUKE, F, GA, GH, MICH, MO, MT, NA, NY, OKL, PENN, RUT, TENN, US, WIS); Putnam Co., near Hurricane, *Gilbert et al.*, SO. APP. BOT. CLUB DISTRIB. 146 (FLAS, MO, NCS, NY, OKL, PENN, TAES, TENN, WVA). KENTUCKY: Calloway Co., se. of Aurora, *Smith & Hodgdon 4050* (GH, NY, US); McCreary Co., Cumberland Falls, *McFarland & James*, 2ND CENT. FL. KENT. 35 (DUKE, GA, MO, NY, PENN, TENN, WIS, WVA, US). TENNESSEE: Cheatham Co., Pegram, *Svenson 10338* (GH, TENN). ALABAMA: Lowndes Co., 23 mi. se. of Selma, *Webster & Wilbur 3511* (MICH). MISSISSIPPI: Amite Co., 5 mi. sw. of Gloster, *Webster & Wilbur 3277* (MICH); Perry Co., 14 mi. w. of Beaumont, *Webster & Wilbur 3405* (MICH). MISSOURI: Howell Co., 4.5 mi. nw. of Willow Springs, *Steyermark 23461* (F, MO). ARKANSAS: Pope Co., Nogo, *Merrill 545* (TEX, UARK). LOUISIANA: Grant Parish, 15 mi. s. of Winnfield, *Webster & Wilbur 3259* (MICH). KANSAS: Cherokee Co., *Hitchcock*, Aug. 1896 (KSC). OKLAHOMA: Pushmataha Co., Antlers, *Palmer 8315* (MO, MT, NY, US). TEXAS: Smith Co., Swan, *Reverchon 3120* (MO, SMU).

4. *Sabatia quadrangula* sp. nov.⁴

Sabbatia cymosa in the sense of G. Don, Gen. Hist. 4: 207. 1838, as to

⁴ *Sabatia quadrangula* sp. nov. Herba annua rosulata, caulibus quadrangularibus, ramis oppositis, pedicellis brevibus, 1-2(-4) mm. longis, corolla alba, 5-partita. Specimen typicum legit R. Wilbur (n. 2899) prope Durham, in Carolina Septentrionali, et in Herb. Universitatis Michiganensis conservatum.

Don's description but excluding reference to *Chironia cymosa* Lam., a synonym of *Sabatia difformis* (L.) Druce.

Sabbatia paniculata in the sense of authors after 1860 but not that of Michaux, the author of the basionym, nor of Pursh who made the combination. The earlier authors were describing the perennial now known as *S. difformis* (L.) Druce.

Sabatia brachiata f. *candida* Fern., RHODORA **39**: 443. 1937

Erect annual (15–)25–45(–75) cm. high, usually with but one stem arising from each rosette, but occasionally with two to several. Roots few to more typically numerous, slender, fibrous, usually widely spreading and shallowly situated, about 4–8 cm. long and less than 1 mm. in diameter. Branches usually restricted to upper one-quarter or one-third of stem, occasionally arising from nodes of the upper half of the stem or rarely from even the lowermost nodes, usually rather strongly ascendent, forming an angle of 15–30 degrees, or occasionally up to 60 degrees, typically opposite along the stem and principal branches, the ultimate ramifications more commonly alternate, the branches forming a flat-topped or convexly corymbose loose to compact crown. Stem strongly quadrate, conspicuously so below, 1–2(–3) mm. in diameter, strikingly although finely membranous wing-angled, wings thin, very low, less than 0.5 mm. in height in the lower portion of the stem and reduced above to the merest trace. Basal rosette present or absent at anthesis, even when present often not well-developed or conspicuous, when well-developed of spreading obovate to spatulate, obtuse to occasionally acute leaves tapering to an almost petiolate base, about 2–4 cm. long and 1.8 cm. wide. Cauline leaves membranous, ascendent, 3-nerved, or only 1-nerved in smaller leaves, somewhat revolute, (0.8–) 1.6–3.2 (–5.8) cm. long, (3–)4–8(–18) mm. wide, obtuse to acute, typically apiculate, usually narrowly to broadly oblong or lanceolate, usually about 3–5 times as long as broad but ranging from about 2–8 times as long as broad, typically at least the lowermost with a strongly clasping base. Internodes often equaling or slightly exceeding the leaf, commonly about 1–2 times as long, but ranging from 0.5–5 times as long as the leaves. Inflorescence of corymbosely to pyramidally arranged cymules, either one, both or none of whose lateral branches may be suppressed, flowers unusually closely associated in the cymule as the pedicels are always short, the flowers often sessile or nearly so, pedicels usually not more than 1–2 mm. in length, always less than 4 mm. long. Calyx-tube thin, 5 ridge-angled, about one-half as long as the corolla-tube, or about 2–3 mm. high, broadly turbinate, 1.5–3(–3.5) mm. long. Calyx-lobes thin, narrowly linear, (2–)4–8(–11) mm. long, usually about 0.5 mm. or less in width, but very rarely lobes as broad as 1.5 mm., erect in bud, and apparently ascendent at anthesis arching upward between the corolla-lobes, usually exceeded by the corolla-lobes by about 2–5 mm. Corolla-tube (2.5–)4–5(–7) mm. long, white but appearing greenish as the ovary is visible through the thin translucent wall. Corolla-lobes

usually oblong, or spatulate, or somewhat elliptic, usually obtuse but not uncommonly acute, (4.5-)6-12(-15) mm. long, (1.5-)3-4(-6) mm. wide, spreading, pure white, occasionally with or more commonly without the basal yellow patch, often turning saffron-yellow upon drying, especially along the reticulate veins. Filaments slender, white, 2-4 mm. long; anthers pale yellow, 1.5-3 mm. long. Stigmatic lobes greenish, lanceolate to oblong, 2-4 times the length of white style, 0.5-1.5(-2) mm. long. Capsule cylindrical, 4.5-7 mm. long, 3-4 mm. in diameter. TYPE LOCALITY: About four miles northeast of Durham, Durham County, North Carolina, TYPE: *Wilbur 2899* (MICH). DISTRIBUTION: Fields, pine-lands and drier savannas from southeastern Virginia south to central Florida. Map 4.

This species has been known for almost one hundred years as *Sabatia paniculata*. This name, based upon *Chironia paniculata* Michx., has long been a source of confusion and error and has been applied by various authors to at least three different species. For almost the past century its application has been rather consistently restricted to the species which is here called *S. quadrangula*.

Michaux's original description in full is as follows:

paniculata. C. firmiter erecta: foliis lanceolato-linearibus; panicula multiflora, brachiata, subfastigata; calyce subulato, corolla semibreviore.

Obs. Caulis lineis 4 prominulis quasi quadrangulus: folia inferiora interdum vali-lanceolata; suprema subulato-setacea. Corollae lacinae oblongae.

Hab. in Georgia et Carolina.

To be sure, there is very little descriptive information here that would be sufficient to allow anyone to be certain or even relatively confident as to which entity Michaux was attempting to characterize. Many of the phrases such as "C. firmiter erecta . . . panicula multiflora, brachiata, subfastigata: calyce subulato, corollae semibreviore . . . Corollae lacinae oblongae" might be applied with equal propriety to several other species. Of the five species included by Michaux, the flower-color of the four others is described as being rose; that of *C. paniculata* is not given. Those characters of the leaf that were mentioned are rather indicative of *S. difformis* (" . . . foliis lanceolato-linearibus . . . folia inferiora interdum ovali-lanceolata; suprema subulato-setacea . . ."). The features of the stem described in the original diagnosis, especially "caulis lineis 4 prominulis quasi quadrangulus . . ." are also a much more

apt description of the stem of *S. difformis* with its four elevated lines or ridges in the upper portion of the stem than it is of the very pronounced and strikingly 4-sided stem of *S. quadrangula*.

It was not surprising, therefore, to find that Michaux's collection, as shown by a photograph in the Gray Herbarium of the type, was a specimen of *S. difformis*. This species is a perennial with a large rhizome; the stem below is terete or with four lines or ridges superimposed upon it, and above the stem becomes somewhat quadrangular; the leaves are ovate-lanceolate, lanceolate, linear to setaceous in a gradually modified sequence from the base to the inflorescence; the corolla-lobes are often 5 mm. or more longer than the longest lobes observed in *S. quadrangula*. The specimen in Michaux's herbarium, as is witnessed by the very adequate photograph, is excellent and most of these features may be observed or interpreted from it. The underground portion of the plant, to be sure, is lacking. It is obvious that the lowermost part of the specimen (which can be seen even from the photograph to be terete or nearly so and approximately twice the diameter of the largest stem of the species that has most recently passed as *S. paniculata*) has been broken from a very substantial underground structure. Therefore *Chironia paniculata* is, both on the basis of its original diagnosis and upon the photograph of the specimen in Michaux's own collection in Paris, but a later synonym for *Swertia difformis* L. (1753), *Chironia lanceolata* Walt. (1788) and *Chironia cymosa* Lam. (1791).

Pursh (1814) transferred Michaux's epithet to *Sabatia* (as *Sabbatia*) listing *Swertia difformis* as a synonym, stating by way of explanation that this species "certainly is the long lost *Swertia difformis*, as the specimens in the Herbarium of Sir Joseph Banks, sufficiently prove." Pursh also formally named as varieties the broad- and narrow-leaved forms of this species with *C. lanceolata* Walt. as a synonym of the latter. Elliott (1817) rather hopelessly confused the white-flowered *Sabatias* nomenclatorially and the influence of his splendid "Sketch" was rather long-lasting. The very different *S. brevifolia* Raf. (*S. elliottii* Steud.) was very well-described, no doubt for the first time, but called *S. paniculata* with the following note by way of explanation: "Though the description of Michaux

applies more peculiarly to the *S. corymbosa* [*S. difformis*], yet as this species was definitely included, and is the only one to which the term *paniculata* is correctly applicable, I have referred to him here." This freedom of interpretation on the part of Elliott caused confusion that persisted for many years. Grisebach (1839) pointed out the confusion but apparently felt that it would be best to apply the name *S. paniculata* in the sense of Elliott, who had been followed by all American authors, and to adopt the name *S. corymbosa* for the perennial species. His list of synonymy showed a very complete understanding of the nomenclatorial propositions that had been made for this last-mentioned entity for the names of Linnaeus, Walter, Lamarck, Michaux, Pursh, and finally Baldwin (or Elliott) are arrayed there. Grisebach apparently included the opposite-branched annual, here called *S. quadrangula*, in the same concept for a duplicate of the specimen of Beyrich cited by him under *S. corymbosa* is the earliest collection of *S. quadrangula* known to me. Chapman (1860) was the first to define *S. paniculata* in the sense that it has been applied in recent times. His action in this, as in most other matters, was heavily influenced by Gray as is shown from a letter (in the National Herbarium, dated December 1883) from Chapman to Dr. J. H. Mellichamp which is here quoted in part.

. . . I well remember the quarrel Gray and I had over it, I contending that the one we now call *S. elliotii*, our really only paniculate species, should bear that name. However, for the sake of uniformity as to our northern and southern Floras, I yield.

The appearance of the Synoptical Flora (1878) firmly established the usage of *S. paniculata* as the name of the white-flowered, opposite-branched annual and this name has been so applied since that date.

Rafinesque (Med. Fl. 2: 77. 1830.) published a description that in some ways strongly indicates this entity. This name has never been identified and I am at a loss to know what species Rafinesque had. *Sabbatia nivea* was described by him as having snowy-white, trichotomose flowers, a four-angled stem and oblong leaves which all would indicate *S. quadrangula* as well or better than any other species. However, the species was definitely stated to have been discovered by him in eastern

Kentucky near the Cumberland River. There is no species known to me from that area which matches his description.

G. Don (1838) transferred Lamarck's *C. cymosa* to *Sabatia* applying it to what is here called *S. quadrangula*. This usage was not followed by any other author. The photograph of the specimen upon which Lamarck's species was based is again what is now known as *S. difformis*.

Gray (1878) placed *S. paniculata* var. *latifolia* Pursh under the synonymy of what is now considered *S. difformis* while placing *S. paniculata* var. *angustifolia* Pursh under the species which I am calling *S. quadrangula* and which he called *S. paniculata*. In other words he felt that Pursh was including two species under *S. paniculata* and Gray also implied that Michaux had done so as well. I am aware of no evidence that has been presented that would warrant such a conclusion.

The only name that has been published previously for this species, whose identity has been for so long known to American botanists, is *S. brachiata* forma *candida* Fernald. This name must be assigned to the synonymy of *S. quadrangula* rather than to *S. brachiata* as the type specimen, *Fernald & Long 6346*, is not an albino of *S. brachiata* as claimed by Fernald, but rather is a specimen of the white-flowered species, *S. quadrangula*. Its identity is shown by the stems which below are strongly quadrate with conspicuously membranous-margined angles and whose pedicels are 2 mm. or less in length so that the flowers appear almost sessile. The only specimen cited by Fernald besides the type was *Seymour 33* which came from Sussex Co., in southeastern Virginia as did the type-collection of Fernald's form. Seymour's plant, seen only at the Gray Herbarium, is *S. brachiata* as is indicated by the stem being terete below and some of the pedicels being over 5 mm. long and many of them over 2 mm. long. The flowers are bleached on the herbarium specimen but, as the sheet was originally determined as *S. paniculata*, they were very likely white. I also have seen white flowered specimens of *S. brachiata* in the field. However, since the designated type of Fernald's form is what is here called *S. quadrangula*, it will be necessary for those who feel it useful formally to designate such minor variations to provide another name for albino plants of *S. brachiata*. Fernald's name could have

been elevated to specific rank for the annual species with a quadrate stem instead of providing an entirely new name. This procedure would seem undesirable as Fernald's intention in describing the form is clear; his choice of type was unfortunate. Besides this consideration, isotypes are not available for that number. Therefore, a new name has been provided and a type designated of which there are many duplicates.

REPRESENTATIVE SPECIMENS:—VIRGINIA: Chesterfield County, near Chesterfield Courthouse, *Fernald & Long 6342* (GH); Greensville Co., nw. of Taylor's Millpond, *Fernald & Long 10785* (GH, PENN); Hanover Co., 1 mi. s. of Ashland, *Ward*, 8 Aug. 1885 (US); Henrico Co., west of Elko Station, *Fernald & Long 8818* (GH); James City Co., south of Hotwater, *Fernald & Long 8817* (DUKE, GH); Pittsylvania Co., Falls Creek, *Heller 1105* (NY, US); Prince George Co., w. of Prince George Courthouse, *Fernald & Long 8816* (GH); Sussex Co., ne. of Homeville, *Fernald & Long 6341* (GH, MO, NY, PENN, US). NORTH CAROLINA: Anson Co., 6 mi. w. of Wadesboro, *Smith*, 30 July 1884 (GH, US); Columbus Co., Nakina, *Schallert*, 30 June 1928 (OKLA); Dare Co., Old Battle Ground, *Bartley & Pontius 489* (NY); Davidson Co., High Rock, *Schallert 8660* (DUKE); Durham Co., about 4 mi. n.e. of Durham, *Wilbur 2899* (MICH); Forsyth Co., without exact locality, *Schallert*, 18 Aug. 1940 (MO, UARK, WIS); Granville Co., Oxford, *Godfrey 5464* (DUKE, GH); Johnston Co., 0.5 mi. n. of Cox's Mill, *Fox 4942* (MICH); Orange Co., Hillsboro, *Gray & Carey*, July 1841 (GH); Randolph Co., Asheboro, *Hood 2399* (FLAS); Rowan Co., vicinity of Salisbury, *Heller 130* (F, MO, NY, PENN); Wake Co., just w. of Morrisville, *Godfrey 49518* (DUKE, FLAS, GA, GH, MICH, NCS); Wayne Co., Goldsboro, *Burlingame*, July 1887 (BRU). SOUTH CAROLINA: Aiken Co., Vancluse, *Eggert*, 6 Aug. 1898 (MO); Anderson Co., Long Branch Church, *Davis*, 29 July 1919 (MO, TEX, US); Beaufort Co., Bluffton, *Mellichamp*, 1884 (F, US); Berkeley Co., 8 mi. s. of Monks Corner, *Wiegand & Manning 2557* (mixed sheets) (CU, GH); Georgetown Co., 12 mi. n. of Georgetown, *Godfrey & Tryon 26* (DUKE, F, GH, MO, NY, US); Jasper Co., Ridgeland, *Mohr*, 1893 (MO); Lexington Co., 8 mi. s. of Columbia, *Godfrey & Tryon 1229* (mixed sheet) (NY); Williamsburg Co., Lanes Station, *Burlingame*, 20 July 1894 (BRU). GEORGIA: Emmanuel Co., near Graymont, *Harper 990* (GH, NY, US); Gwinnet Co., between the Alcovy River and No Business Creek, *Small*, 14 July 1893 (F, GH, MO, NY, US); Johnson Co., 2.5 mi. w. of Wrightsville, *Pyron & McVaugh 3083* (GA); Mitchell Co., few miles e. of Pelham, *Thorne 5078* (CU); Newton Co., 4 mi. n. of Covington, *Pyron & McVaugh 3036* (GA, NA); Sumter Co., without exact locality, *Harper*, July 1897 (NY); Telfair Co., McRae, *Biltmore Herb. 4511* (US); Washington Co., 3 mi. n. of Harrison, *Pyron & McVaugh 3104* (NA, NY). FLORIDA: Bay Co., Panama City, *Knight*, 6 July 1943 (FLAS); Calhoun Co., without exact locality, *Chapman* (MO); Dixie Co., near east limits of Jena, *Beaman 280* (MICH); Franklin Co., Apalachicola, *Chapman* (GH); Gulf Co., north of Port Saint Joe, *Small, DeWinkeler & Mosier*, 11 July 1924 (DUKE, FLAS, GH, MICH, MO, NCU, NY, PENN, TENN, WVA); Levy Co., Rosewood, *Garber*, June 1876 (BRU, F, NY); Hamilton Co., near Jennings, *Bright 3902* (WIS); Taylor Co., between Perry and the Gulf of Mexico, *Small, Small & DeWinkeler 11452* (NY, US); Wakulla Co., prope St. Marks, *Rugel* May 1843 (MO, US); Walton Co., Freeport *Mohr*, 18 June 1880 (US).

5. ***Sabatia brachiata*** Ell., Sk. Bot. S. C. & Ga. **1**: 284. 1817. *Chironia angularis* var. β *angustifolia* Michx., Fl. Bor. Am. **1**: 147. 1803. *Sabbatia concinna* Wood, Class-Book ed. 2. 451. 1847. *S. angustifolia* (Michx.) Britton, Mem. Torr. Club **5**: 259. 1889.

Erect annual (10–)25–50(–67) cm. tall, usually but one stem arising from each rosette, more rarely with 2 or 3. Branching usually restricted to the upper one-third or half of stem but in more robust plants with branches sometimes developing from the lowermost nodes, usually rather strongly ascendent forming an angle of 15–40 degrees with the main stem, rarely spreading to as much as 70 degrees, typically opposite, although rarely alternate along main stem or principal branches, or ultimate branches somewhat more commonly alternate, forming convexly corymbose or somewhat pyramidal loose to compact crown. Stem 1–2(–4) mm. in diameter, terete, conspicuously so below and smooth, not wing-angled, although sometimes noticeably lined or finely ridged. The stem above and upon the branches becoming subquadrate or even quadrate and bearing very slight wings at the angles. Roots few to numerous, slender, fibrous, spreading or descendent, about 4–8(–10) cm. long, 0.5–1.5 mm. in diameter. Basal rosette typically present at time of flowering, usually conspicuous, typically composed of numerous overlapping, spreading, usually broadly spatulate, rarely elliptic, obtuse to seldom acute leaves tapering strongly to an almost petiolate base, (8–)15–30(–45) mm. long, (6–)10–14(–18) mm. wide. Cauline leaves membranous, ascendent, 3-nerved or rarely only 1-nerved in smaller leaves, (1–)1.5–3(–4.5) cm. long, (3–)4–10(–16) mm. wide, often obtuse, especially below, or acute, commonly slightly callose-apiculate, oblong, with more or less parallel margins, or more rarely elliptic or somewhat lanceolate, tapering somewhat to base, at least usually not strongly or broadly clasping. Internodes usually about 1.5–3 times longer than the leaves, but ranging from but about three-fourths to about 4-times as long as the leaves. Inflorescence of corymbosely to pyramidally arranged cymules either 1, both, or none of whose lateral branches may be suppressed. Pedicels 5-sided, noticeably thin-ribbed, (1–)2–8(–13) mm. long. Calyx-tube thin, noticeably but finely 5-ribbed, usually about half as long as the corolla-tube, (1–)1.5–3(–4) mm. long, turbinate to campanulate. Calyx-lobes thin, narrowly linear, (4–)7–10(–15) mm. long, 0.3–1.0 mm. wide, ascendent in bud, wide-spreading at anthesis, usually exceeded by the corolla lobes by 3–8 mm. Corolla-tube (3–)4–5(–6) mm. long, 1.5–3 mm. in diameter, cylindrical, greenish within and without. Corolla-lobes oblong, or narrowly to broadly spatulate, usually obtuse, or occasionally tapering to an acute apex, (5–)7–14(–20) mm. long, (2–)3–6(–8) mm. broad, wide-spreading at anthesis, pale-pink to darker roseate, rarely white, with low triangular greenish-yellow area at base of lobe, usually bordered by reddish line. Filaments slender, pale yellow to nearly colorless, (1.5–)2–3(–4) mm. long; anthers bright yellow, usually about (2–)3(–4) mm. long. Stigmatic lobes slender, (2–)3–5(–7) mm. long; style 2–4 mm. long, usually less than the stigmatic branches in length. Capsule cylin-

dricul, 5–8 mm. high, 3–4.5 mm. in diameter. TYPE LOCALITY: "Grows in the middle and upper country of Carolina. Near Columbia," Lexington Co., South Carolina. TYPE: *Herbemont s. n.* (CHARL!). DISTRIBUTION: Fields, dry and open oak and pine woods ranging from southeastern Virginia south into Georgia and westward to southern Missouri and Louisiana. Map 5.

This well-marked species has been rarely confused with any other, except occasionally with specimens of *S. angularis* or *S. quadrangula* (which for almost a century has been called *S. paniculata*). Both of these last-mentioned species are, however, readily distinguished from *S. brachiata* by their strongly tetragonal stems whose angles are strikingly membranous winged. *S. brachiata* is strongly contrasted to those two species by possessing, especially below, a smooth, terete stem. Above and on the branches the stem is somewhat finely ridged and angled but not conspicuously so. The corolla of *S. brachiata* is typically pink or roseate and very robust specimens, especially in areas where *S. angularis* is more commonly to be expected, have been rather often mistaken for that wide-spread species. Albinos of *S. brachiata* are rarely encountered, but when they are found or when the corollas become entirely bleached as they often do in drying, these plants are often mistaken for what has previously been called *S. paniculata* (= *S. quadrangula*). The type of *S. brachiata* forma *candida* (Fernald & Long 6346), is not *S. brachiata*, which normally has a rose-colored corolla, but *S. quadrangula* (*S. paniculata* in the sense of recent authors) which always has a white corolla. Fernald's misidentification of the type-sheet is easily demonstrated: the lower portion of the stem of the type is very distinctly quadrate with winged margins which is a distinctive feature of *S. quadrangula*. The only other specimen cited with the original description of this "form" was *Seymour 33* which is definitely a specimen of *S. brachiata*. A new name will be required by those who feel it essential to designate formally such minor variations.

Chironia angularis β *augustifolia*, of Michaux, has been assigned to the synonymy of this species at least since the appearance of the Synoptical Flora, where it was so listed. Not having seen an authentic specimen from Michaux's herbarium, it is only tentatively that I place the name in the synonymy of *S. brachiata*. The original characterization of the variety was

very brief (“ β *augustifolia*: foliis quasi lanceolatis; supremis etiam linearibus”) and certainly states nothing that would exclude forms of *S. angularis* from consideration or indicates clearly that the entity described was *S. brachiata*. Both this variety of Michaux’s and his *latifolia*, which has been considered the sole element of Michaux’s concept that is *S. angularis* as now interpreted, were arranged under the generalized diagnosis of the species. The stem in that account of the species is stated to be “marginato-quadrangulo” and this would seem to exclude the entity now known as *S. brachiata*. Perhaps Gray saw an authentic specimen at Paris and hence may be correct in his treatment; in any event the question is yet to be settled.

S. concinna Wood is assigned to the synonymy of this species upon the basis of the original description which led Gray as early as 1856 to the same conclusion. It is perhaps of some significance that Wood himself later listed the name as a synonym of *S. brachiata*. The original description follows:

3. *S. concinna*. Wood (*Nov. sp.*) *Elegant Star Flower*. St. slender, sub-quadrangular, internodes 2–4-times longer than the leaves; *branches* opposite, sub-erect; *lvs.* linear and lance-linear, lower ones ovate, all acutish, sessile, *panicle* oblong; *cal.* segments linear, twice longer than the tube, twice shorter than the corolla; *cor.* 5-parted, segments oblong-obovate, obtuse, light purple.—Dry grassy prairies, Ia.! abundant. Stem a foot high, few or many-flowered. Leaves 9–12" by 1–3", flowers 15" diam., of a delicate blush purple, the star in the center yellow, bordered with green. Jl. Aug.

Merrill (*RHODORA* 50: 127. 1948.) concluded that “it is the same as *S. campestris* Nutt., not *S. brachiata* Ell. as the latter species does not occur in Iowa; Wood’s type was from Iowa.” However, Wood described the branches as opposite and the calyx-segments as linear and only half as long as the corolla and these features would exclude from consideration anything but an unusual specimen of *S. campestris*. If the plant were *S. campestris*, it would hardly seem possible that the very peculiar and prominent costae of the calyx-tube could be overlooked in even the most cursory examination. I have seen no specimen of *S. campestris* from Iowa. Merrill placed considerable weight of evidence upon the locality of the plant but his interpretation of the abbreviation “Ia.” is certainly an error. In 1846 between

the first and second editions of his Class-Book, Wood, enlarging the area to be covered by his flora, made a short collecting trip to Indiana. *S. concinna* was presumably seen upon that trip. The explanation of geographical abbreviations appearing in the second edition informs one that "the names of . . . states . . . are often abbreviated, and always in the same manner as in other works; thus . . . Ia. or Ind., Indiana, &c." In this same edition (1847, p. 3) the area of the flora was said to be "essentially the States lying north of the Ohio River and Maryland." One also learns in Wood's "American Botanist and Florist" that the "geographical limits of the present flora are the same as those adopted in the Class-Book: viz, all the States of the American Union lying east of the Mississippi River." Although the area covered by Wood's publications was expanded in later years, they were never intended to cover the region west of the Mississippi River except indirectly. Wood meant Indiana by the abbreviation "Ia." Fernald (Rhodora 47: 404-405. 1945) concluded as much from indirect evidence.

S. brachiata is not represented from Indiana in any of the herbaria that I have studied and neither it nor *S. campestris* were included by Deam in his Flora of that state. In fact, Deam (1940, p. 1080) after considering the evidence and after finding that that species was not represented in either the Gray Herbarium or in that of the New York Botanical Garden definitely excluded it from the known flora of the state. Fernald (1950) lists the range of the species as including southern Indiana. *S. brachiata* is not represented from Indiana, Illinois, or Kentucky in any of the collections that I have studied. The nearest known stations are southeastern Missouri and in Tennessee.

The description of the stem as being "subquadrangular" is also a bit puzzling if the name really is synonymous with *S. brachiata*, for that species is very conspicuously marked by a decidedly terete stem in at least the lowermost portion. The upper part of the stem and the branches do become rather strongly angled and, if *S. concinna* is the same as *S. brachiata*, this explanation probably accounts for that at first puzzling statement in the description. The disposition of Wood's name, in the absence of authentic material, will remain tentative, but the evidence available indicates that it was *S. brachiata*.

REPRESENTATIVE SPECIMENS:—VIRGINIA: Princess Anne Co., Little Neck, *Fernald & Long 4134* (GH, PENN); Prince George Co., just s. of Disputanta, *Fernald & Long 8815* (GH); Sussex Co., northeast of Homeville, *Fernald & Long 6344* (GH, NY, PENN, US). NORTH CAROLINA: Anson Co., 4 mi. n. of Ansonville, *Boyce 1127* (NCS); Beaufort Co., 7 mi. s. of Washington, *Godfrey 4400* (GH, US); Brunswick Co., 3 mi. n. of Bolivia, *Wilbur 2888* (MICH); Bladen Co., without exact locality, *Biltmore Herb. 4511a* (GH, MO, NCU, NY, PENN, US); Carteret Co., 3 mi. se. of Newport, *Godfrey 48192* (NCS); Cumberland Co., 7.5 mi. n. of Fayetteville, *Godfrey & Fox 49446* (DUKE, NCS); Harnett Co., 6 mi. e. of Cameron, *Fox 2546* (NCS); Montgomery Co., 1 mi. n. of Ether, *Wiegand & Manning 2543* (CU); Moore Co., 2 mi. s. of West End, *Fox & Whitford 3903* (MICH, NCS); New Hanover Co., Wilmington, *McCarthy*, Aug. 1885 (US); Onslow Co., at Richlands, *Godfrey 4475* (GH, US); Sampson Co., Roseboro, *Godfrey 4532* (DUKE, GH, US); Scotland Co., 12 mi. n. of Laurinburg, *Godfrey 5046* (DUKE, GH, US); Wake Co., Raleigh, *Godfrey 4918* (GH, NCU, NY); Wilkes Co., up Pores Knob, *Radford & Stewart 1743* (NCU). SOUTH CAROLINA: Chesterfield Co., near Cheraw, *Ward*, 25 June 1895 (NY, US); Darlington Co., Society Hill, *Canby*, July 1878 (F, NY); Horry Co., without exact locality, *Adams 30* (PENN); Lexington Co., 8 mi. s. of Columbia, *Godfrey & Tryon 1229* (GH, NY [a mixed sheet], US). GEORGIA: Bartow Co., 1.25 mi. e. of Emerson, *Duncan 8548* (GA, MO); DeKalb Co., northern slope of Stone Mountain, *Small*, 17 July 1893 (F, NY); Douglas Co., 10 mi. s. of Douglasville, *Duncan 3648* (MICH); Pickens Co., near Jasper, *Biltmore Herb. 4511a* (US); Richmond Co., Augusta, *Cuthbert*, Aug. 1876 (RUT); Taylor Co., without exact locality, *Pyron*, 3 Aug. 1930 (DUKE). TENNESSEE: Coffee Co., near Manchester, *Clebsch & Clebsch 4770* (TENN); Franklin Co., between Tullahoma and Estill Springs, *Svenson 9211* (GH); Grundy Co., east of Altamont, *Svenson 7137* (GH, TENN); McNairy Co., without exact locality, *Bain 431* (GH, NY); Van Buren Co., Falls Creek State Park, *Shanks, Clebsch & Sharp 3431* (MICH, TENN); White Co., sw. of Clifty, *Shanks, Clebsch & Sharp 2916* (TENN). ALABAMA: Mobile Co., about 8 mi. sw. of Mobile, *Webster & Wilbur 3479* (MICH); Washington Co., Fruitdale, *collector not stated*, July 1904 (MO). MISSISSIPPI: Covington Co., 1.5 mi. se. of Mt. Olive, *Webster & Wilbur 3308* (MICH); Forest Co., about 14 mi. s. of Hattiesburg, *Webster & Wilbur 3397* (MICH); Harrison Co., 3 mi. s. of Saucier, *Webster & Wilbur 3442* (MICH); Jackson Co., Ocean Springs, *Pollard 1083* (MO, NY, US); Jones Co., Laurel, *Tracy 3356* (NY); Pearl River Co., Poplarville, *Tracy 1687* (GH, US); Pike Co., Holmesville, *Wheeler* (MO); Stone Co., 8 mi. s. of Wiggins, *Webster & Wilbur 3440* (MICH); Wayne Co., 6 mi. nw. of Ala.-Miss. state line, *Sargent*, 18 June 1950 (OKL, NCS). MISSOURI: Butler Co., 12 mi. n. of Poplar Bluff *Steyermark 11593*, (MO). ARKANSAS: Faulkner Co., Conway, *Haas 1629* (US); Drew Co., Ladelle, *Demaree 22321* (MO, OKLA); Lonoke Co., Grand Prairie, *Demaree 22333* (MO, NY, OKL, OKLA); Prairie Co., DeValls Bluff, *Demaree 22176* (MO); Pulaski Co., near Little Rock, *Carpenter*, June 1938 (UARK). LOUISIANA: Calcasieu Parish, Lake Charles, *Daves*, Aug. 1888 (F); Grant Parish, 4 mi. s. of Pollock, *Webster & Wilbur 3257* (MICH); Orleans Parish, New Orleans, *Drummond 224* (GH, K); Rapides Parish, 12 mi. se. of Hineston, *Webster & Wilbur 3275* (MICH); St. Tammany Parish, vicinity of Covington, *Arsène 11741* (US); Tangipahoa Parish, 6 mi. e. and 1 mi. n. of Hammond, *Nease*, 1945 (OKL); Vernon Parish, 2 mi. w. of Leander, *Webster & Wilbur 3228* (MICH); Washington Parish, Bogalusa, *Cocks*, 5 June 1917 (NO).

(To be continued)